SPAWAR Develops Innovative Approaches to Human Systems Integration

By Dee Quashnock

The Space and Naval Warfare Systems Command (SPAWAR) is exploring a number of innovative approaches for achieving greater mission effectiveness while maximizing the Navy's workforce capability. Leading this effort, is the SPAWAR Human Systems Integration (HSI) team in the Office of the Chief Engineer. This headquarters team directs a corporate-wide team comprised of teams located in SPAWAR field activities.

HSI integrates human capabilities and limitations into system definition, design, development and evaluation to optimize to-

Operational Environment

Figure 1.

tal system performance in operational environments. It is part of the total systems engineering approach to analysis, design, development and testing. Figure 1 shows the elements of the operational environment.

FORCEnet is the Navy's road to transformation for network-centric warfare. It integrates warriors, sensors, command and control, platforms and weapons into a networked combat force. FORCEnet is the key enabler of Sea Power 21; it provides the foundation for Sea Basing, Sea Shield, Sea Strike, Sea Warrior, Sea Trial and Sea Enterprise.

The FORCEnet Functional Concept, which was approved by the Chief of Naval Operations and the Commandant of the Marine Corps, characterizes the FORCEnet environment as collaborative, decentralized and agile. "FORCEnet is all about command and control, and HSI provides the focus on the warfighter," said Capt. Rick Simon, FORCEnet Coordinator at the Naval Network Warfare Command (NETWARCOM).

One result, since the issuance of the FORCEnet Functional Concept, is new constructs such as distributed staffs. Members may be embarked on forward-deployed units supported by a shore-based staff of domain specialists available to provide technical support via Web-based, service-oriented information systems using an agile semantic framework for dealing with disparate data.

This functional concept draws attention to several HSI issues, including distributed decision-making, shared situational awareness, system-of-systems training, reliable collaboration tools and displays to promote effective command and control. HSI has played a significant role in supporting the decomposition and expansion of the FORCEnet Functional Concept to ensure that
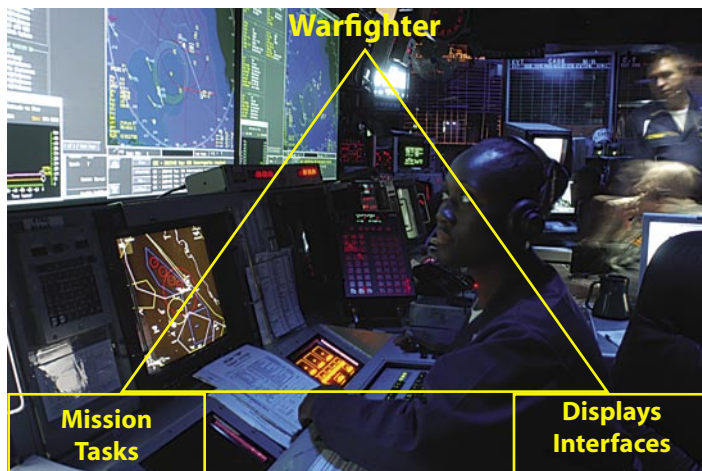
cognitive and decision processes are adequately represented.

The Marine Corps Combat Development Command, NETWARCOM and the Office of the Chief of Naval Operations (OP-NAV) Resources, Requirements and Assessments (N81) have supported SPAWAR's efforts to incorporate HSI considerations into the documentation that articulates the FORCEnet concept as part of the Defense Department's Joint Capabilities List.

Transforming the Navy into a decentralized, more distributed, agile workforce demands effective HSI efforts that address not only the traditional HSI disciplines of manpower, personnel, training and human factors but also such disciplines as organizational psychology and even cultural anthropology.

Organizational psychology is very much a part of HSI. HSI is about the interaction of human operators with the technologies they use. It includes how operators communicate, coordinate and collaborate information with other humans in the system. Cultural anthropology offers insights and a discipline for studying and comparing organizational constructs among and within organizations.

Trident Warrior 2004, an annual FORCEnet Sea Trial experiment led by NETWARCOM, initially examined FORCEnet concepts. Experimentation in Trident Warrior improved tactical situation awareness, provided speed to capability, a rapid fielding of improved FORCEnet command and control warfighting capability to the fleet, and supported the development of tactics, techniques and procedures to optimize new technologies for the execution of naval operations.

During Trident Warrior 2004, the HSI team collected data from a wide range of FORCEnet technologies designed to support operational mission capabilities, such as ISR (intelligence, surveillance and reconnaissance), targeting and tactical operations in a complex global war on terrorism scenario.

In TW04, the HSI team found a good shared understanding of exploited imagery and ISR products afloat and ashore; effective collaboration with no loss of service via the Distributed Chat Architecture; and an accurate understanding of network status via a new Advanced Digital Network System technology.

> FORCEnet is the key enabler of Sea Power 21; it provides the foundation for Sea Basing, Sea Shield, Sea Strike, Sea Warrior, Sea Trial and Sea Enterprise.
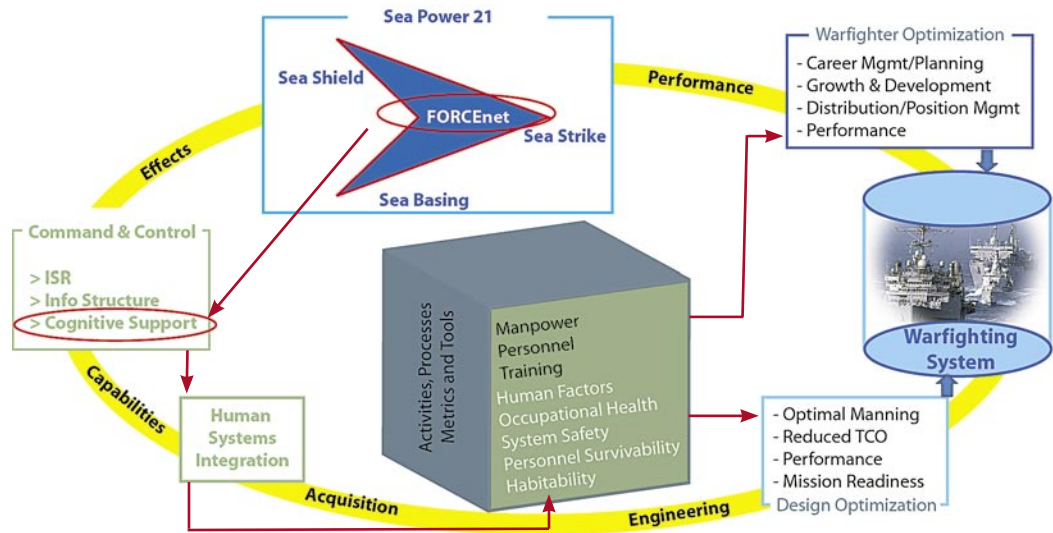

Figure 2. HSI Enterprise Architecture.

We used the results to make recommendations for the Military Utility Assessment (MUA) to request continued development for the programs associated with these technologies to further improve warfighting capabilities.

The HSI team collected data on operator performance, situation awareness and system usability. The HSI findings were influential in the Operational Agent's Assessment and the MUA to make decisions regarding acquisition programs based on how well operators and mission performance are supported by advanced FORCEnet technologies. Both the HSI methods and the Trident Warrior results have been very well received by military and system engineering groups in the United States and abroad.

The SPAWAR HSI team continues to take a significant leadership role in the analysis of FORCEnet systems in Trident Warrior 2005. In coordination with other initiative areas including joint and coalition organizations, HSI is providing comprehensive quantitative and qualitative human performance data related to a variety of systems, including chat tools, network visualization tools, information operations, Voice over Internet Protocol /video teleconferencing over IP, cross-domain solutions and information management plans.

In addition, HSI is spearheading the development of an improved concept to update commanders as part of the regular battle rhythm and to form a response in crisis situations. Each of these efforts demonstrates the impact that HSI has had on moving the emphasis from technology-based assessment to mission-based analysis. Mission-based analysis considers how effectively human operators and decision makers are integrated with information technologies and networks.

SPAWAR is part of the Human Systems Performance Assessment Capability (HSPAC), a Navy infrastructure that will allow individual and system-level human performance to be assessed and certified. The Usability and Engineering Research Lab and the Composeable FORCEnet Human Systems Integration (CFnHSI) Lab in Point Loma, Calif., will be a key part of this distributed capability. HSPAC will enhance fleet readiness and operational effective-

ness at the lowest total ownership cost by providing personnel, expertise, equipment, connectivity, tools, models, environments and alliances necessary to measure, analyze, assess and certify Sailor performance in warfighter systems across all life-cycle phases. Figure 2 shows the HSI enterprise architecture.

SPAWAR 052 is working closely with the Virtual SYSCOM HSI Working Group to define a common taxonomy of human performance measures and metrics that can be shared and applied to a broad array of systems analysis tasks. SPAWAR's efforts led to the rapid implementation of an initial taxonomy accessible in flexible formats via an HSI ontology software application that has now formed the basis for a continuing metrics effort by HPC and Virtual SYSCOM working groups.

SPAWAR recognizes that there are several key features for an effective distributed workforce and has taken the lead in integrating these features into its systems. These features include:

√ *Common operational picture (coordinating representation) and collaboration tools (feedback);*
√ *Shared understanding of team roles, capabilities, goals, deadlines and priorities;*
√ *Operating tempo aligned across distributed teams;*
√ *Technology and reliable communications with a high degree of usability;*
√ *Consistent, current and easily accessible data;*
√ *Training and procedures for how to employ technologies in a system-of-systems approach.*

These HSI efforts directly support initiatives to transform the Navy's Human Capital Strategy through Sea Warrior. The strategy is focused on a distributed, capable workforce that uses FORCEnet to realize the vision of distance support teams, composeable systems capability and agile forces to rapidly execute the Navy's missions.

Dee Quashnock is the director, architecture and human systems in the SPAWAR Office of the Chief Engineer. CHIPS